A RESEARCH PROPOSAL

"INTEGRATIVE ANALYSIS OF NATIVE HERBAL EXTRACTS FOR WOUND HEALING POTENTIAL"

Submitted

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INTRODUCTION

A wound is a type of injury in which the skin is torn, cut, or punctured (an open wound), or a contusion is caused by blunt force trauma (a closed wound). From minor skin damage to more serious injuries including deep cuts that lead to chronic wounds, wounds can take many different forms. Bones, muscles, tendons, arteries, nerves, and organs can all be destroyed by severe trauma that penetrates deep into subcutaneous tissue. Wound healing is the process by which internal or external body structures regain their physical integrity.[1] While the wound infection as a result of microbial invasion of soft tissue, resents significant clinical problems for both diagnosis and effective treatment selection. Acute wound infections can appear in burn, traumatic, and surgical wounds, but chronic wound infections are linked to diabetic foot ulcers, pressure ulcers, and venous leg ulcers.[2]

The indigenous traditional healers used a variety of plant parts as medicine, including the root, stem, leaf, flower, fruit, seed, rhizome, tuber, bark, pulp, latex, and gums/resin. Plant parts utilized as a source of the bioactive ingredient for wound healing were found to have a distribution analysis. The following was the order of the plant part percentage analysis. 30 percent leaf > 16 percent whole plant > 15 percent root > 11 percent seed > 10 percent fruit > 14 percent stem > 4 percent flower. Additionally, the majority of wound-healing cures were derived from the leaves, then the entire plant. However, plant components such as latex (40%) oil (30%) gums (5%) and others (25%) were used in a variety of ways as the source of herbal medications to aid in wound healing. Remarkably, the majority of treatments used to encourage wound healing came from a single plant. But occasionally, it has been reported that two portions of the same plant or two or more species can be combined.[3]

Furthermore, depending on the type of plant and plant part used, the preparation and delivery of the medication differed greatly. The majority of the formulations put to use were pastes made by crushing plant material. In extremely rare instances, formulations intended for external application contained animal components. The mixture also used animal products (such milk or urine) as a component. The afflicted area of the body is covered with the paste. As an alternative, fresh plant material's juice or dry plant material in powder form were also utilized. The practitioners' methods of preparation can be broadly divided into four categories: decoction created from fresh plant materials, powder made from dried plant materials, juice derived from fresh plant materials, and plant pieces used as a paste. To speed up the healing process, the

preparations were applied externally (to cuts or wounds) and consumed internally. More plants were always employed for the same purpose as an alternate source because traditional healers more often used the plants that were accessible at the time to treat cuts and wounds.[4,5] Approximately 7.5% of India's population is made up of more than 400 distinct tribal and other ethnic groups. Though there have been numerous reports of tribal or indigenous communities using plants for traditional healing, there has also been a surge in interest in the study of medicinal plants and their traditional use in various parts of India in recent decades. In addition to tribal groups, many other forest dwellers and rural people also have unique knowledge about plants. Herbal plants have long been used extensively to treat a variety of wounds. To determine whether medicinal plants and their chemical components have a therapeutic effect on wound healing, testing is required. The use of plant derivatives is becoming more popular these days because they have fewer negative effects. Several studies have demonstrated improved outcomes in treating a variety of wounds, including diabetic, infected, and open wounds. In the present day, it has been discovered that herbal crude medications and their chemical components are more effective for treating wounds.[6]

When applied to wounds, phytoconstituents found in herbal plants exhibit their potential to promote tissue re-modeling and act as proangiogenic agents. The herbal plants *Pinus pinaster, Centella asiatica, Aloe vera. Hypericum patulum, Burseramorelensis, Argania spinosa, Lavandula angstiforia, H. perforatum Copaifera paupera Schaueriana Avicennia, Ximenia americana, Fumaria vaillantii, Cucurbita pepo,Ginseng Panax, Euphorbia hirta, Vaccaria segetalis, Sapindus mukorossi, Sauromatum guttatum, Astragali radix,Cydonia oblonga, Pupalia lappacea, Berula angustifolia, Ampelopsis japonica , Bauhina recemosa, Cittoria Chrozophora, Nigella sativa, Ficus racemose, Elaeis guineensis,Artocarpus communis, Annona muricata, Sida corymbose, Blechnum orientale Aegle Marmelos Bacopa monniera, Cinnamomum verum, Moringa oleifera, , Anacardium occidentale, Ephedra alata, Ficus racemose,* and *Calotropis procera* has wound healing potential. They have vitamins, tocopherols, essential oils, resins, fatty acids, glycosides, alkaloids, tannins, steroids, carbohydrates, terpenoids, carotenoids, flavonoids, cardenolides, and other phenolic components that aid in wound healing. Most plants and their chemical components exhibit their effects through the process of angiogenesis through the actions of NF-κB, TGF-β, VEGF, tumor necrosis factor (TNF), and inducible nitric oxide synthase (iNOS) on cytokines; in addition to this, there are other mechanisms, including those of

IL-4, IL-5, IL-13, and TGF-β1.Re-epithelialization, which reduces wound size, is another factor in wound healing.[7]

The number of studies investigating how well plant extracts aid in wound healing and the bioactive elements that trigger or regulate the healing process has increased throughout the past two years. Studies show that Flavonoids, Alkaloids, Saponins, and Phenolic chemicals are responsible for the notable efficacy of a number of herbal medications in the treatment of wounds. Through a variety of mechanisms, including as anti-inflammatory, antibacterial, antioxidant, collagen synthesis-stimulating, cell proliferation, and angiogenic actions, these phytochemicals can operate at different stages of the process.[8,9] The development of novel wound care treatments that incorporate the use of herbal healing agents with contemporary goods and procedures is the direction of current wound care trends. Additionally, plant extracts and their phytochemicals' nanostructure can improve their bioavailability, regulate their release into the wound site through sustained delivery systems, and increase their permeability to the underlying skin layers—all of which are critical for the healing process. Many plant extracts and their natural constituents have shown great efficacy in wound care when employed in nanoformulations, and as a result, they may be used as pharmaceutical medications.[10,11,12]

LITERATURE REVIEW

Goyal *et. al.* 2024 This review article studied increasing interest in plant-based solutions for healing wounds. Studies showing a variety of discovered pathways for better healing have led to a growing recognition of medicinal plants' ability to heal wounds with fewer adverse effects, especially in diabetic, infected, or open wounds.

Zeba Fatima *et. al.* 2024 This systematic review stated that wound healing is a dynamic process that engages multiple cellular and physiologic pathways in the body. Wounds must be treated as soon as possible to ensure appropriate healing; otherwise, there may be a chance that an infection will develop later. Because of the major limitations and issues that affected conventional pharmaceutical agents, older formulations, and delivery systems, scientific studies have shown that natural extracts with the ability to heal wounds when formulated using nanotechnological methods are superior and play a significant role in the field of medicine and drug delivery.

S. A. El-Sherbeni, W. A. Negm *et. al.* 2024 This review intends to provide a quick overview of the wound-curing properties of various plant extracts and entirely natural materials in experimental animal models of burns, incisions, and excisions in mice, rats (both diabetic and nondiabetic), and rabbits throughout the past five years, with or without infection. The in vivo investigations provided solid proof of the effectiveness of natural remedies in appropriately healing wounds.

Megha V. S *et. al.* 2024 This review concludes that the development of vesicular systems with improved delivery performances is the main focus of wound healing research & it also explains different emerging novel strategies and approaches for the cure of wounds such as nanotherapeutics, stem cells therapy, 3D bio printed skin, extracellular matrix-based approaches, platelet-rich plasma-based approaches, and cold plasma treatment therapy. Vesicular nano systems demonstrate advantageous qualities, such as biocompatibility, targeted and sustained administration capacity, and improved phytocompounds bioavailability and protection, conferring their a tremendous potential for future applications in wound care.

Shubham Hange *et. al.* 2023 This review seeks to understand the therapeutic potential of Bauhinia Racemosa by relating traditional ethnomedical knowledge with recent scientific findings. All parts of the plant, including the roots, leaves, stem, flowers, and seeds, have pharmacological activity. The plant *Bauhinia racemosa (Lam.)* contains flavonoids, crude protein, fat, tri-terpenoids (α-amyrin), stilbenes (resveratrol), β-sitosterol, tetracyclic lupeol, betulin, and tetracyclic 2, 2-dimethyl chroman. Additionally, this plant has antibacterial, antipyretic, anticancer, antihistamine, antidiabetic, anthelmintic, antioxidant, antiulcer, and analgesic properties. The plant is also vital for sustenance.

Akshay U et al 2023 This With an emphasis on its mechanisms of action and supporting data for its effects on the different stages of the wound healing process, the paper describes preliminary phytochemical screening and critically evaluates the literature on curcumin's present applications in wound healing. Indicates that it has anti-inflammatory and wound-healing properties in cream and ethanol extract formulations.

Vitale, S *et. al.* 2022 It summarizes the most recent in vitro, in vivo, and clinical research on the main herbal preparations, their phytochemical components, and novel wound care formulations is compiled.

Jain *et. al.* 2022 This review indicates that different plant species have a variety of chemical contents, but it makes no indication of which chemical compounds are crucial for wound healing. Most of the literature does not identify the chemical components that cause wound healing; instead, it only cites research on extracts in different solvents that exhibit wound healing activity. Therefore, there is a lot of promise for the future in identifying chemical constituents (phytochemical screening) utilizing different chromatographic and spectroscopic techniques and figuring out which chemical constituents found in plants show wound healing.

Uzma Saleem *et. al.* 2022 In this article the methanolic extract of C. arvensis stem (CaME) was examined in this work using GC-MS and HPLC. CaME's potential for wound healing is supported by promising antioxidant activity and In silico validation of its phytoconstituents' affinity for wound healing targets.

Jinaan *et. al.* 2021 The review revealed that studies on B. purpurea and B. variegata plant has enormous biological potential. It is quite likely that the comprehensive data on the phytochemical and other biological characteristics of the extracts included in this review will offer comprehensive proof for the plant's application in a variety of therapeutic applications. Additionally, this study shows that more research should be done on Bauhinia species and their quantification of individual phytoconstituents as well as their pharmacological profile based on in vitro, in vivo, and clinical trials.

Memona Fatima *et. al.* 2021 According to the review, Bauhinia racemosa's phytochemistry, pharmacology, and traditional medicinal uses are useful for upcoming investigations and research aimed at discovering novel compounds and pharmacological activity.

N. Nayeem, S. Mohammed Basheeruddin Asdaq, A.S. Alamri *et al.* 2021 This article presents study of the wound-healing properties of different herbal formulations using methanolic and chloroform extracts of Dodonaea viscosa leaves in Sprague Dawley rats using incision and excision wound models. A topical application of ointment was made once day until the wound

had healed completely. The effects of wound healing were evaluated by measuring the tensile strength in the incision wound model and the epithelization duration in the excision wound model.

Chandan K. Sen *et. al.* 2020 This article's foundation is the growing interest in comprehending how the socioeconomic determinants of health affect wound care patients' quality of life and results. Furthermore, the significance of telemedicine alternatives in the continuum of care has been brought to light by the COVID-19 pandemic's impact on wound care. An organized approach to wound care, education, and related research is necessary due to the growing economic, clinical, and societal effects of wounds.

Marziyeh Hajialyani *et. al.* 2018 In this article the effectiveness of plant-based Nanomaterials in wound care is reviewed, and the therapeutic targets implicated are discussed based on a thorough investigation of in vitro, in vivo, and/or clinical data assessing the effectiveness and pharmacological mechanisms of nanostructures derived from natural products on various wound types.

Pragati Khare *et. al.* 2018 The study on Kanchnara (Bauhinia variegata Linn.), a medicinal plant that may be able to treat a number of illnesses, is presented in this article. According to this study, this plant exhibits Antimicrobial, Antiarthritic, Antigoitrogenic, Anti-Inflammatory, Anthelmintic, Antitumor, Cytotoxic, Antiulcer, Haemagglutination, Hepatoprotective, and Insecticidal properties.

Maria Cristina P.P. Reis Mansura *et. al.* 2016 This article based on study of Bauhinia Microstachya var. Massambabensis Vaz, Fabaceae, oil-in-water photoprotective emulsion. The compositions' safety and efficacy were assessed both in vitro and in vivo. The formulations' effectiveness was assessed using Spectrophotometric techniques and the in vivo Colipa test, which measured the formulations' Sun Protection Factor (SPF) and UVA protection factor. Also the Red Blood Cell, CAM-TBS, and HET-CAM assays were conducted as part of the in vitro safety evaluation.

Keith Cutting *et al* 2016 This article discus that the Infection is thought to be the primary cause of delayed healing in both acute and chronic wounds & the need for medicines to

effectively control these conditions as well as the financial burden they place on European nations.

Sreeraj Gopi *et. al.* 2016 this review indicates that in the wide range of health issues, nanotechnology offers enormous potential for delivering herbal medications and nutraceuticals. As such, its application for efficient disease prevention and health promotion is both required and expected. Although nanotechnology presents intriguing avenues for nutraceutical and herbal medication delivery, more creative research is required to address the long-term safety and cost-effectiveness of the nanomaterials.

Krishnaveni Marimuthu *et. al.* 2014 According this research, both qualitative and quantitative tests reveal that Bauhinia Purpurea leaves and flowers contain chemical elements and nutrients that may be used therapeutically in the creation of herbal formulations.

Rafik U. Shaikh et. al. 2014 This study found that many individuals in different regions of Nanded district still rely on medicinal plants to heal their illnesses, and that traditional medicine is accessible for treating a variety of ailments.

Neelima, *et. al.* 2012 In this study, the chemical structure of β-Sitosterol was isolated from an ethanol extract of the aerial portions of Bauhinia Purpurea. Several physical (solvent extraction, column chromatography) and spectral approaches were used in its execution.

S. Ramya *et. al.* 2009 The results of this study led to the identification of 82 species of medicinal plants, spread across 39 families, that Malayalis utilise to treat cuts and wounds. This study is an effort to compile data on the body of ethnobotanical knowledge now in existence and record traditional claims for the creation of safe and efficient herbal medications for cuts and wounds.

STATEMENT OF PROBLEM

Over the years the advancement in research has been takes place results in availability of many traditional herbal formulation in the market for wound care & treatment. They have poor solubility, absorption, bioavailability & delayed therapeutic effect. Therefore our research aims at identification of potential of plant parts extract for its wound healing property & preparation of

suitable formulation using Novel drug delivery technology It will helps to develop herbal formulation reduced therapeutic dose which overcomes shortcomings of traditional herbal formulation.

SIGNIFICANCE OF STUDY

In many parts of the world, the traditional usage of medicinal herbs to treat wounds dates back thousands of years. Due to their wide range of active ingredients, accessibility, and little adverse effects, a number of plant extracts and their phytoconstituents are regarded as a possible substitute for wound healing treatments. The effectiveness of therapeutic plants, their phyto-components, and the mechanisms underlying their wound-repairing action have all been demonstrated by recent scientific studies. Recent developments in research aid in the evaluation of herbal plants and the creation of appropriate formulations through the use of sophisticated analytical and artificial intelligence (AI) integrated approaches. It increases the effectiveness of several herbal and medicinal products.

OBJECTIVES OF RESEARCH

- To perform extraction of plant part using suitable solvents using scientific literature.
- To evaluate wound healing potential of extract by phytochemical screening
- To identify the lead molecule against wound healing target protein from LCMS using In silico docking.
- To evaluate pharmacological activity of herbal plant extract.
- To prepare Polyherbal formulation using Novel drug delivery system.
- To assess the in-vivo wound healing activity of prepared Polyherbal formulation using Animal model.

HYPOTHESIS

In recent times, there has been a notable focus on the advancement of novel, secure, eco-friendly, expandable & reasonably prices delivery methods that have potential to convert conventional herbal remedies into product with good healing property is seen. The integration of AI & novel drug delivery approach helps in identification of lead molecule along with preparation poly herbal formulation with enhanced wound potential.

METHODOLOGY

1. **Collection and authentication of plant material:** The whole plant or its parts will be collected from the known sources. The sample identification & authentification will be done by the BSI, Pune.
2. **Processing of plant material:** Collected plant material will be subjected to processing such as drying, grinding, sieving etc as per official standards.
3. **Pharmacognostic evaluation of plant material:** Whole plant or its parts will be subjected to Pharmacognostic evaluation for Morphological Evaluation and Microscopic evaluation.
4. **Extraction of plant material with various solvents:** Coarse powder form of plant material will be subjected to successive extraction. The solvent & extraction method will be decided according to chemical constituents & its nature.
5. **Phytochemical screening of Plant extract**.
6. **In -vitro study of herbal extract**
7. **In-silico study**: To know lead molecule , toxicity, ADME etc.
8. **Preparation of Polyherbal formulation using Novel drug delivery approach**.
9. **In-vivo study:** Evaluation of wound healing property of Prepared Polyherbal formulation compared with marketed formulation as standard for the study using Animal model.

EXPECTED OUTCOME

Use of advanced analytical techniques, novel drug delivery system along with AI integration in preparation of Polyherbal formulation helps to get desired novel product with enhanced efficacy which is eco-friendlily & can be made available less price. It will reduce growing socio- economical & clinical effects of wound.

RESEARCH WORK PLAN

Sr. No.	Work	Period
1	Literature survey	12 months
2	Collection or procurement of Plant material	

3	Processing of Plant material	
4	Preparation of extracts by using various solvents, procurement, drying of extracts	03 Months
5	Extraction of phytochemical	02 Months
6	Identification& characterization of phytochemical	04 months
7	In-vitro study of herbal extract	
8	In silico study	02 months
9	Preparation & evaluation of suitable formulation & In-vivo study	03 months
10	Other work, Compilation of data, Interpretation and Conclusion	04 months
11	Thesis writing, Paper publication & Presentation of research work.	06 months
	Total duration of work	36 months

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